

## Survey on air pollution monitoring system using sensors

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**Abstract** --- The innovative urban city was developed due to the convergence of various human activities such as construction with the development of information technology. The Pollution levels has been intensified by developments that stereotypically occur as countries become industrialized and urbanized. Increasing air pollution levels leads to many hazards such as global warming, acid rains, skin and lung related disorders etc., In-order to elude such cases, monitoring of the quality of air in the environment is highly necessary.

Wireless Sensor Networks is an outstanding and emerging technology that is used for sensing, measuring pollutant levels and transmit information in the central server. The server makes use of machine learning (ML) algorithm for building accurate forecasting performances. The quality of air is determined by measuring the levels of ozone (O<sub>3</sub>), nitrogen dioxide (NO<sub>2</sub>), carbon dioxide (CO<sub>2</sub>) and sulphur dioxide (SO<sub>2</sub>) by their threshold values. The input from the sensor nodes is transmitted to the android device with the help of zigbee module and output is displayed to the user.

**Keywords**—Air quality monitoring, wireless sensors network, machine learning (ML) algorithms, Zigbee.

### I. INTRODUCTION

Air pollution is caused due to the percentage and amount of pollutants in the air. Air in the environment is polluted due to increase in urbanisation and industrialisation. This is due to deforestation. In the recent years large number of trees have been cut down for the benefit of various human activities in order to spread the cover of rising urban population. This apparently leads to increase in the amount of green house gases which are the major pollutants in air and leads to global warming. Other side effects caused by the escalation of these pollutants in the environment is acid rains, skin cancer and lung disorder. Various industries within the city limits, emit harmful substances in the form of smoke. This combines with the oxygen molecules in the atmosphere and form harmful gases like carbon dioxide (CO<sub>2</sub>), sulphur dioxide (SO<sub>2</sub>), ozone (O<sub>3</sub>) and methane. Smoke emitted from vehicle due to the ignition of fossil fuels also produce smog which may cause temporary blindness and other ailments in the human body.

So, considering the present scenario, we need highly need a system to witness the increasing air pollution mainly in metropolitan cities. For which a system for checking and observing the pollution levels and air quality is required.

### II. RELATED WORKS

In the year 2009[1] Mr. Shashikant proposed, the implementation of a related system in monitoring air pollution intended to make use of embedded wireless system. This concept was designed with a GSM module, ARM controller, semiconductor sensors and a central-server. The Central-Server is a modern personal computer application server. The amount of pollutants in air is

examined and filled in a frame which consists of time and date unlike other systems. The pollutants detected were classified into two types:

- Primary pollutants
- Secondary pollutants

The sensor devices and the microcontroller was connected in an electronic circuit. The output produced was the amount of pollutants observed by the sensors which was being passed on to the amplifier circuit and then to the analog to digital converter and finally sent to the controller. The microcontroller played a major role and was important component in the detection unit.

The pollution detection system can be used by clients for various applications like environmental habitat monitoring, travel agencies, safety measures for public, to ensure healthcare of patients or people in a particular locality. Any user can enable connection to the Central-Server with a use of Internet and can check the air pollutants level by a standard web browser using internet on a desktop computer or a hand-held devices. The Server can also be tangibly located with the help of GPS.

In August 2013,[2] Parveen Sevusu stated that, “**System of Real-time Air Quality Monitoring through Mobile Sensing**” the paper says about the approach for measuring air quality in real-time. It consists of two topics one is mobile sensing models and another one is data management. In implementation details, it consists of mobile sensing box, personal sensing device and cloud server.

In first level, it performed with the two platforms. One is sensing the device which is placed outside of the objects and in another, NODE is mounted inside the things while mobile sensing is still outside. This work revealed several challenges, which we plan to address in our future work. They are:

Sensor Location, Sampling strategy, Server aggregation, Incentives and applications. Therefore the two models presented in this paper consists of public infrastructure which is used for bus travelling at scheduled times with the reputed efficient stream of pollution measures and for the public community-identifying models. The air quality data obtained using detecting models that could serve the different applications like patients with cardiovascular diseases, health aware.

In 2013[3] Ms. R.A Roseline, pollution monitoring using wireless sensor network stated that, the advancement in micro-electromechanical system eventually lead to the invention of mini sensor nodes. The system made use of collection of relatively smaller sensor nodes when compared

to the existing systems. This was a major advantage. These nodes were connected to the Central Processing Unit (CPU) and a wireless transceiver which enabled the system to monitor the pollution levels. There were several technologies which were made use to implement how pollution can be monitored. There were three major ways :

- **GPRS sensor array**

This system made use of single chip microcontroller , Global Positioning System(GPS) and number of air pollution detection sensors for detecting the composition of various pollutants in the air such as CO, NO<sub>2</sub>, SO<sub>2</sub> .

- **Indoor Air Quality monitoring (IAQ)**

This technology functioned using IAQ sensor which was mainly used to measure the volume of heat ,ventilation etc., in buildings. The IAQ sensors are kept in various locations of a building.

- **Mobile Air Quality Monitoring Network (MAQUMON)**

The MAQUMON consisted of number of sensor nodes , Bluetooth or USB cable and GPS with which periodic measurements of quality of air was being uploaded to the server.

However , all these technologies were based on Wireless Sensor Networks and did not produce accurate results and updates were not given to the server continuously .

In May 2015 in “**Detecting of Air Pollution Using Intelligent Control System**” by [4] Anil.H.Sonune, presents the zigbee protocol to monitor and diagnose. First it senses the air pollution level through the sensors. The sensing array consists of air pollution sensor nodes which comprises of carbon monoxide (CO), temperature and gas. After which it converts it into the analog and digital. Then it compares the pollution level with standard reference values.

If the pollution level is high or critical. It sends the transmission Id, data, start bit, stop bit. Then finally it sends the data through transmitter. If the pollution level is low it waits for 15mins and then it starts again for sensing.

In February 2016 [5] Ashwini S. Kale proposed, air quality and pollution monitoring system using transferable GPRS sensors was convincing with which devices such as integrated single chip microcontroller, a modem, air pollution sensor array and Mobile Data Acquisition Unit (mobile-DAQ) were embedded . The levels of each pollutant present in the air is observed and are packed in the form of frames and are transferred to the GPRS modem and are directed to the server through a dependable network. The pollution server is synchronised with Google Maps by which the real-time pollutant (CO<sub>2</sub>, NO<sub>2</sub>, SO<sub>2</sub>) levels are determined by 24/7 basis.

In the month of May 2016, [6] R.Khodve proposed a system based on air pollution monitoring system with the help of smart phones. Here, the system consists of a relay driver kit and consists of two relays which measures both temperature and air pollutants (smoke, NO, CO). If the temperature is more, fan is switched on. If the pollution is identified to be more then the alert is generated on the LCD which is connected with the microcontroller. The system makes use of microcontroller which senses the measured values of impurities in the air or smoke which is produced by various human activities. The LM1117 Integrated Chip is linked with the Bluetooth and data sensed is sent to android phone

.The maximum threshold values for temperature is 40 and for smoke it is 45.

In May 2016, [7] Aruljothi.R states a system used for indicating air pollution using mobile sensor arrays. This system makes use of ARM controller and data aggregation method. The system consists of three modules GPS, GPM and pollutant sensor interface. The GPS with the help of two RS232 ports tracks the location of pollution approximately which is represented by longitude and latitude. The sensor estimated output is displayed in the LCD screen. Here there is no use of emerging technologies like zigbee or android.

During the past year, that is in 2016 July [8] Anjaiah Guthi, an efficient system for air and noise pollution monitoring using Internet Of Things (IOT) which is one of the emerging technologies in the recent years was made use. IOT in general actually emerged by combining both computer science and electronics. The sensors are connected to the embedded system which makes sure whether the fluctuation of pollution is examined . This system should be observed, controlled and behavioural analysis should be conducted often.

The hardware components used are the arduino board, collection of sensor nodes and MATLAB with arduino hardware support package. The main advantage is that each sensor is kept at different locations and can be supervised recurrently with a help of internet. The data congregated are warehoused in a cloud where large volume of data can be deposited and retrieved. Other existing system made use of database for storage which made it cumbersome when enormous volume of data was stored. The disadvantages of a database can be overcome by a cloud.

## V. CONCLUSION

The system utilizes wireless sensor networks. The data shows the composition of each gas , their levels of pollution and the area's air quality standards. Here successful design of the system with android operating system which shows the real time data or pollutants present in the air on the output device which can be accessible from any corner of the world so, we have designed circuit which detects and makes a counteractive act on the increase of air pollution based on the particular threshold value obtained while monitoring the environment.

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